Physics 139
Spring 2010
Homework 10
Due Friday, April 9, 2010

Reading Assignment: Hartle, pp. 242–253, 255–264. In my opinion, it is easier to understand the material of Sec. 11.1 if you first do the case in which the source is on-axis. In that case, the apparent angle θ of the source is the Einstein angle θ_E (thus you get a clear physical meaning of the Einstein angle). Then think about the (more complicated) case when the source is off-axis. This is how I did it in lecture.

I'm not giving any problems on accretion disks because there is too much other material and because the analysis of accretion disks follows closely what we have done in several earlier problems involving particles in orbits emitting photons. But take a look at Fig. 11.8—it is very interesting.

On p. 261 he says the normal vector to the event horizon points in the r-direction. I don't know if this is a typo or an error, but I would ignore it.

1. Problem 11.2, p. 253.

2. Problem 11.7, p. 254.

3. Problem 11.10, p. 254.

4. Problem 12.8, p. 277.

5. Problem 12.12, p. 278.